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ABSTRACT

This book introduces journal-writing prompts in mathematics for geometry. Content prompts, attitudinal or affective prompts, and process prompts are presented. Each of the content prompts relates or connects topics within and outside of mathematics, targeting important or meaningful concepts and skills. The content prompts also provide situations that focus on areas where students often have misunderstandings or misconceptions. Attitudinal or affective prompts focus on students' feelings about themselves as mathematicians and students of mathematics. The responses to the process prompts can give insight into students' preferences for problem-solving strategies and how they learn or remember. (KHR)

The "Write" Way Mathematics Journal Prompts



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FOR GEOMETRY

Barbara J. Dougherty and Jenny Simmons



A Publication of the University of Hawai'i's
Curriculum Research & Development Group

The "Write" Way

Mathematics Journal Prompts

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Using Writing in Your Classes

1. Share with students the rubric you are using.
2. Make copies of the rubric for students to keep in their notebooks and post one copy in the classroom.
3. Give students a practice prompt to write about. Allow about six minutes for them to respond. The practice prompt is usually an affective/attitudinal one. Regardless of the type you select, it should be one that all students can attempt.
4. Have students compare what they wrote with samples of other students' work that you provide. Or ask them to compare work with their partner or table mate.
5. Compare their work with the rubric. Have students focus on three things they could do to move their writing up a level. If their writing is already at the top level, ask them to write another question that this prompt made them think of.
6. Allow three minutes for students to correct or revise their work. (They should strive to reach the two top levels.)
7. Collect the work.
8. For the first writing prompt to be done outside of class, assign a prompt that you think *all* students can write about.
9. When students return to class with their assignment, have them compare their writing with the rubric.
10. Allow two minutes for students to correct or revise their work. (They should strive to reach the two top levels.)
11. Repeat this phase as often as needed to help students understand your expectations for their writing.

The “Write” Way: Mathematics Journal Prompts for Geometry

The *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000) includes a separate standard for Communication for grades 6 through 8 and 9 through 12. This standard advocates using multiple activities that give students opportunities to demonstrate their understandings. These tasks should allow students to express themselves in a variety of ways such as with concrete models, pictures or drawings, or abstract symbols. Each of these forms lets students communicate with others about their thinking.

Communication should include at least five types of activities: (1) speaking, (2) reading, (3) listening, (4) modeling or constructing, and (5) writing. The last type can take the form of journal writing.

Journal writing can be structured to give you cohesive and comparable information about students and their thinking while you are challenging them through contextual situations. A structure for journal writing includes (1) mathematical content, (2) students' attitude or affect, and (3) processes.

Journal prompts give situations or questions to which students respond. Responses may include words, pictures or drawings, or symbols. Students should be encouraged to support their ideas or to clearly explain what they mean. They can give specific examples as part of their explanations.

Content prompts relate or connect topics within and outside of mathematics, targeting important or meaningful concepts and skills. They can also provide situations that focus on areas where students often have misunderstandings or misconceptions. The responses to the prompts give teachers (and students) insight into how a student has interpreted a mathematical idea.

Attitudinal or affective prompts focus on students' feelings about themselves as mathematicians and students of mathematics. Students' responses allow you to assess how positive attitudes about mathematics and mathematicians are developing in the classroom environment.

Finally, being aware of how one solves or approaches problems is promoted by **process prompts**. The responses to these prompts can give insight into students' preferences for problem-solving strategies and into how they learn or remember. As students become aware of how they learn and solve problems, they grow stronger in confidence.

Introduction: Geometry

Description of materials

There are at least 100 prompts to choose from. Some of them may be used more than once to ascertain how students are growing in their understandings of and beliefs about mathematics. The prompts may also be used as assessment tasks for expanded response or self-constructed response items.

Each mathematical content prompt includes a short description of what you might expect or consider in students' responses. The mathematical content responses should reflect a student's progress in understanding the concept or skill.

The content prompts were selected to match recommendations from the National Council of Teachers of Mathematics (*Principles and Standards for School Mathematics*, 2000) rather than to fit a specific text. Locate the topic that you are studying and then select the prompt that best fits the class. You may change the wording if students will not understand the terminology or vocabulary used.

Affective or attitudinal prompt responses show students' beliefs. If you use them more than once, you should be able to detect changes in beliefs or feelings about mathematics as a discipline as the year or semester progresses.

Process prompts give students an opportunity to show how they do a mathematical process or algorithm (step-by-step procedure). When you use these prompts, you gain insight into how students have interpreted or altered procedures.

You can use writing prompts daily or intermittently, depending on your class, and you can repeat them from time to time. In prompts that use students' names, feel free to change the names to represent your students. If you use journal prompts daily, we recommend that students respond to three content prompts, one process prompt, and one attitudinal prompt in a week.

Evaluating students' responses

When we tested journal writing in classes, we found that students tend to give the writing more thought if it is to be scored. One method our writing team used was to score the responses on content rather than on grammar and spelling. We used an essay grading method, reading two or three papers to get a feel for students' responses. These first papers formed the baseline for scoring other papers.

We designed this rubric for scoring journal responses.

4 points:	The student's work includes— • a completed prompt or an answer to the question posed. • support for statements made by using either examples or counterexamples. • ideas clearly communicated to the reader. • legible writing, drawings, pictures, charts or tables, and diagrams. • accurate mathematics or information.
3 points:	Omission of one criterion from level 4.
2 points:	Omission of two criteria from level 4.
1 point:	Omission of three criteria from level 4.
0 points:	Omission of more than three criteria from level 4.

There are many ways to create a rubric. Teachers alone can develop a rubric, or students can work with the teacher to develop a rubric specific to their class. Here are two sample rubrics that have been developed with students' participation.

A five-level scale:

- 4 The student's work shows a response that—**
 - addresses the question raised in the prompt.
 - has correct or accurate mathematics.
 - is legible.
 - has support or justification for any statements made.
 - makes sense to the reader.

- 3 The student's work shows a response that—**
 - addresses the question raised in the prompt.
 - has correct or accurate mathematics.
 - is legible.
 - does not have fully justified or supported statements.
 - makes sense to the reader.

- 2 The student's work shows a response that—**
 - addresses the question raised in the prompt.
 - has some incorrect or inaccurate mathematics.
 - is legible.
 - does not have justified or supported statements.
 - is somewhat clear to the reader.

- 1 The student's work shows a response that—**
 - addresses the question raised in the prompt.
 - has incorrect or inaccurate mathematics.
 - is partially legible.
 - does not have justified or supported statements.
 - does not make sense to the reader.

- 0 The student's work shows a response that—**
 - does not address the question raised in the prompt.
 - has incorrect or inaccurate mathematics.
 - is not legible.
 - does not make sense to the reader.

A three-point scale:

- Exceeds standard** The student's work shows a response that—
- addresses the question raised in the prompt.
 - has correct or accurate mathematics.
 - is legible.
 - has support or justification for any statements made.
 - makes sense to the reader.
- Meets standard** The student's work shows a response that—
- addresses the question raised in the prompt.
 - has some correct or accurate mathematics.
 - is legible.
 - does not support or justify some of the statements made.
 - makes sense to the reader.
- Below standard** The student's work shows a response that—
- does not address the question raised in the prompt.
 - has incorrect or inaccurate mathematics.
 - is not legible.
 - does not support or justify statements made.

Although grammar and punctuation are not usually scored, students should communicate their ideas in ways that are understandable. Some students may use drawings, tables, charts, or other means to convey their ideas. They should be encouraged to use whatever way they need to make their ideas clear.

After the first writing assignment, you can take excerpts from students' papers to illustrate qualities that you consider important. Show comparisons between high- and low-quality responses by putting them on overhead transparencies or photocopying them for all students. Keep the responses anonymous.

Content Prompts: Geometry

You can present the prompt to the whole class and have students share ideas. You can record their ideas on chart paper or on the board. The chart paper provides a permanent record that can be revisited later in the year to check the progress of students' understanding of or thinking about mathematical concepts or skills. At that time, you can revise students' comments or add new add ideas.

You can also use the prompts in a problem-solving context where students create a solution in a group or individually. If groups work on the problems, they can share their ideas before the whole class. If they work individually, you will need to find some way to provide a sharing of ideas. Either way, their ideas should be recorded for future reference.

1. I use inductive reasoning when . . .

Students discuss the use of facts for deductive reasoning and the basis of observation for inductive reasoning. Examples given by students could be used in class discussions. The prompt can specify deductive reasoning instead of inductive reasoning.

2. Carmen said, "Why do we always have to give a reason when we make an argument or proof in geometry?" What do you think Carmen's teacher told her?

For an argument or proof to be reliable, you must give reasons to substantiate a statement. Without reasons, others may not follow your argument or proof.

3. Tricia thinks that definitions are not needed in geometry. Write a convincing argument telling why definitions are important.

Students' arguments should be rational and convincing to any reader. They may include an explanation of conventions or accepted ideas.

4. **“This book says a point has no dimensions,” said Paul. “What does that mean?” Describe what you think it means to Paul.**

A point has no length, width, or breadth. Students may compare it to a one-dimensional line or a two-dimensional plane.

5. **Which is longer, a ray or a line? Why?**

Students might argue that a line is longer because it has no beginning or end and a ray has an endpoint. They both have infinite length.

6. **To conjecture means to . . .**

Students should discuss conjecturing in a way that links it to hypothesizing. Some students may comment on how a conjecture is formulated by using deductive or inductive reasoning.

7. **Desiree said, “A postulate is like a theorem.” “No,” said Emma. “A theorem is different.” Who do you agree with? Explain.**

Students should clearly distinguish the two and cite supporting examples. A postulate is accepted as true, but a theorem can be proven.

8. **Arden said, “I have a method to help me determine if a polygon is convex or not convex.” What do you think her method is? Describe and support it with an example or drawing.**

Students may say they extend a side to see if it intersects the polygon, or they may use the idea that diagonals extend beyond the polygonal region.

9. **Wanda asked her teacher how many different ways two angles could intersect. What do you think your teacher would say? Why? Support your response with drawings and an explanation.**

Students should describe a variety of intersection possibilities including a point, two points, three points, four points, a line segment, and a ray.

10. **“A rhombus can be a square,” said Todd. “A rhombus can also be a trapezoid,” said Calvin. Do you agree with Todd or Calvin? Why or why not?**

A rhombus can be a square, but it is not a trapezoid. Students should agree with Todd. If you are using the definition that a trapezoid has at least one pair of parallel sides, you may want to adjust your expectations of students' responses.

11. **Write a story problem that uses properties of polygons to solve it. Solve your problem.**

Students' responses should include a problem that uses polygonal properties accurately. Their solution should be complete.

12. **A right triangle can (or can not) be equilateral because . . .**

Students should indicate that it cannot be equilateral and then give a justification. The justification may include an explanation about the sizes of angles or the lengths of sides.

13. **Anthony said, “That’s interesting. I just noticed that every quadrilateral has 360° as the sum of the interior angles. “Is that always true for any quadrilateral? Even ones that are concave?” asked Mark. How would you answer Mark? Justify your answer.**

Students should respond that it is true for all quadrilaterals. They should provide a justification.

- 14. You can determine the number of diagonals a polygon has by . . .**

Some students may give an algebraic representation. Others may provide a method that involves intuitive thinking. If you notice both types in the responses, you may want to hold a class discussion about the processes described.

- 15. An octagon and a dodecagon are alike (or different) because . . .**

Students should compare and contrast the two polygons. You may want to add criteria for the number of similarities or differences that you expect in the response. Other polygons can be substituted.

- 16. Find at least one way in which triangles differ from other polygons. Support or validate your statement.**

A difference that many students report is that a triangle has no diagonals. Others discuss parallelism.

- 17. A regular polygon is one that . . . Support your description with examples and non-examples of regular polygons. Can a regular polygon have any number of sides and angles?**

Students should emphasize that a regular polygon is both equian-gular and equilateral. Their responses should include drawings and supporting explanations.

- 18. Skew lines are . . . Give a representation of skew lines that could be found outside the classroom.**

There are many interesting examples outside the classroom. The prompt helps students distinguish between parallel and skew.

19. Seth found a geometric drawing on the classroom floor. Describe what he found.



This prompt may introduce the idea of a transversal. Some students may describe the drawing as two angles intersecting in a segment. Discussion of alternate interior angles may also appear.

20. If l is parallel to m and l is perpendicular to p , what conclusions can you draw about l , m , and p ? Make a sketch to represent the given information.

At a minimum, students should conclude that m is perpendicular to p . Students may also include the parallel and perpendicular relationships given in the statement.

21. Respond to the following statement by making a diagram and writing a paragraph to prove or disprove it:

If two parallel lines are cut by a transversal, then the bisectors of two alternate interior angles are parallel.

Students should write a valid argument to prove the statement is true.

22. Give a theorem involving parallel lines that a parking lot painter would use. How would he use the theorem you chose?

For example, if a student chose the theorem that corresponding angles are congruent if lines are parallel, the painter would use this to mark off parking spaces. He could also use perpendicular lines to paint lines in a parking lot.

- 23. Kendell wants to mirror the wall of her dressing room with regular polygons. What geometric shapes can Kendell use to complete the wall? Draw a pattern for Kendell to go by.**

Kendell would need equilateral triangles, squares, or regular hexagons to complete her wall. You may want students to generalize ideas about the shapes that can be used. You may want to change the prompt to allow students to create new shapes that tessellate.

- 24. Latisha said, "What are the important properties of a parallelogram that I should remember?" What would you tell Latisha? Use drawings to support your answer.**

Students should include parallelism, relationships of diagonals, angle equivalencies, and symmetry. Accept responses that reflect the class discussion about parallelograms.

- 25. Using ideas about parallel lines, compare and contrast rectangles and trapezoids. Be sure to validate your statements.**

Responses should reflect your class discussion about rectangles and trapezoids. Encourage students to respond with more than a definition.

- 26. In $\triangle JAM$, D is on JA , $DB \parallel JM$, and $BE \parallel JA$. Describe the figure formed by the parallel lines and support your answer.**

$DBEJ$ is a parallelogram. Students should write a valid explanation of how they know the figure is a parallelogram.

- 27. Linda said, "Congruence means the same thing as equality." Do you agree or disagree? Why or why not?**

If you use this prompt at the beginning of the year, students may consider these two the same idea. But as they study congruent figures, the differences should become evident.

- 28. Lauren said, "All equiangular triangles are congruent." Do you agree or disagree? Why or why not?**

Students should disagree because AAA is not enough information to prove triangles are congruent. An equiangular triangle is equilateral, but two equiangular triangles could be of different sizes. Hence they are not congruent.

- 29. Write a mathematical argument or provide conclusive diagrams or drawings to show that the median from the vertex angle of an isosceles triangle divides the triangle into two congruent triangles.**

Students can use SSS to argue that the two triangles are congruent. Students may also state that the two triangles formed are right triangles.

- 30. Mandi said that once she proves two triangles are congruent by AAS, she can also conclude that . . .**

The other pair of angles is congruent as well as the other two pairs of corresponding sides because corresponding parts of congruent triangles are congruent.

- 31. Find and explain a counterexample to disprove the following.**

If two sides and a non-included angle are congruent to the corresponding parts of another triangle, then the two triangles are congruent.

SSA is not a valid argument for proving two triangles congruent. Their counterexample should be appropriately labeled.

- 32. Congruent triangles are used in furniture manufacturing. Find another occupation that uses congruent triangles. Describe how they are used.**

Construction workers (roofers, bridge builders, and tilers), quilt makers, and land surveyors are a few examples students may give.

- 33. Will said, "I have learned several methods to determine if two triangles are congruent. I wonder if those methods could be used to show that other polygons are congruent." What do you think? Explain.**

Students may compare the methods to methods for other polygons. Watch for the appropriate use of angle and side determinations.

- 34. The Golden Ratio, approximately 1.6, can be found in the ratio of sides of an 8×5 index card ($\frac{8}{5} = 1.60$). Find two other items such that the comparison of two parts of the items is approximately the Golden Ratio. Substantiate your findings.**

Students may find other rectangles such as picture frames, playing cards, buildings, or the ratio of your total height to the height of your waist from the floor.

- 35. Meagan says she can make a figure similar to a cartoon character by copying the character with play putty and stretching it. Christy says she can make a similar figure by enlarging the character on a photocopier. Which one do you agree with and why?**

Students should agree with Christy. Meagan's copy would be distorted. An enlargement from the photocopier will be done proportionately.

- 36. Make a statement using similarity about the figure described below. Defend your statement. Draw the figure.**

Scalene triangle, with a parallel segment (in its interior) to one of the sides.

Students should note that a segment parallel to a side of a triangle divides the triangle, making a triangle similar to the larger tri-

angle. They might set up corresponding proportions. Be prepared to accept different responses.

- 37. Select a polygon. Explain, using that polygon, how ratio is related to similarity.**

Responses should indicate that corresponding sides have the same ratio. Students may suggest various ways of finding different ratios.

- 38. Draw two quadrilaterals that are similar, one with at least one side that measures 6 units and one with at least one side that measures 10 units. Draw two quadrilaterals that are not similar, one with at least one side that measures 6 units and one with at least one side that measures 10 units.**

Students may draw two squares for the first pair and a rhombus and a square for the second pair.

- 39. David says two regular hexagons are always similar. Duane asks, "Are all isosceles triangles similar?" How do you think David answered Duane?**

Responses should indicate that David will say that not all isosceles triangles are similar. He may tell Duane that an isosceles triangle with vertex angle measure of 40° would not be similar to an isosceles triangle with vertex angle measure of 50° .

- 40. Cammie said, "I have an obtuse triangle that is similar to a right triangle." "That's impossible," said Tammie. Who do you agree with? Why?**

Students should agree with Tammie. They should support their choice with an appropriate argument for similarity. For example, they may indicate that an obtuse triangle has an angle larger than 90° . Since a right angle is the largest angle in a right triangle, the two triangles cannot be similar.

- 41. The four triangles formed by joining the midpoints of the sides of a scalene triangle are similar to the original triangle. Draw what the figure would look like. Choose one of the triangles and explain why it is similar to the original one.**

Students may use any other valid method to explain why the triangle is similar to the original one. Their drawing should be accurate.

- 42. Draw a triangle with an area of 36 square units and label the sides and other appropriate parts. Draw a rectangle with an area of 36 square units and label the sides and other appropriate parts. Describe what you notice. (Use graph paper.)**

Students' observations encompass a broad range. Some students may notice that a right triangle with an area of 36 square units does not have the same side measures as the rectangle. Their drawings should correspond to their observations.

- 43. Alan said, "I have a new way to find the area of a rhombus. Just find the length of the two diagonals and multiply them." Do you agree with Alan? Explain.**

Alan is incorrect. An alternative method for finding the area of the rhombus is to take half the product of the diagonals. To extend the prompt, ask students to support their answer with a verbal explanation of why that method works.

- 44. Naomi wondered, "A parallelogram and a trapezoid are not shaped the same. I wonder if it's ever possible to find a parallelogram with the same area as a right triangle." What do you think? Justify your answer.**

Students should note that both rectangles and squares are special cases of a parallelogram. Given that relation, they should be able to find multiple examples. Some students may use other parallelogram cases for their response.

- 45. Dean said, "When two figures are similar, their areas and perimeters have special relationships." What did Dean mean?**

Students should justify their responses with examples, or some may use algebraic means. For example, if students use similar squares, their perimeters will be in the same ratio as the sides, but the ratio of the areas will be the ratio of the squares of the sides. Encourage them to try figures other than quadrilaterals.

- 46. Summer said, "The larger the radius, the larger the circumference." Do you agree with her? Why or why not?**

The circumference is directly related to the radius. Thus as the radius grows larger, the circumference increases.

- 47. Collett was really excited. She had discovered that if you increase the perimeter of a rectangle, you also increase the area. What do you think? Support your answer with specific examples.**

This is not true. That relationship between perimeter and area does not hold for all cases. To extend the prompt, change it so that Larry discovers that if you increase the area of a rectangle, you also increase the perimeter.

- 48. Dillon is a new student in your geometry class. He seems to have difficulty determining the perimeter of polygons. Give him some of your helpful hints.**

Students should share means to determine perimeter. Watch their responses for a conceptual understanding of perimeter.

- 49. Jessica lives in an unusual house; its rooms are shaped like kites. Find a method for her to determine the area of a room. Justify your method.**

Some students will subdivide the kite into other shapes. Students' responses should reflect the class discussion about area.

- 50. Describe to Sally how you would reflect scalene triangle ABC over line l if point C is on the line. Do the reflection.**

Students should note there are three vertices that must be reflected—A, B, and C. Since C is on the line, C is its own image.

- 51. Describe the line(s) of symmetry of a line segment, an angle, a rectangle, and a square. Is there only one line of symmetry in each case? Name a figure with no lines of symmetry.**

A segment has one line of symmetry, the perpendicular bisector of the segment. An angle has one line of symmetry, the angle bisector. A rectangle has two lines of symmetry, two segments joining the midpoints of the sides. A square has four lines of symmetry, the diagonals and the segments joining the midpoints of the sides. A scalene triangle is one example of a figure with no lines of symmetry.

- 52. What is the result of reflecting $y = x$ about the y -axis? Do the reflection.**

The image is $y = -x$ or $-y = x$. An appropriate reflection should be included.

- 53. To perform a rotation, I need to know . . . Give an example of a rotation.**

Students need a pre-image, a center of rotation, and a rotation vector or the angle of rotation. Any examples of rotations can be used in the class discussion.

- 54. Given an image and a pre-image, how can you determine the center of rotation and the rotation vector?**

Students should give an appropriate method. Their methods can be verified in class the next day.

- 55. If you rotated $y = x$ forty-five degrees about the origin, what is the result? What is the result of a 90° rotation? How could you get the image $y = -x + 2$?**

A 45° rotation would result in $x = 0$ or $y = 0$, depending on the directional arrow. A 90° rotation would be $y = -x$ or $x = -y$. To get an image of $y = -x + 2$, one possible method is to rotate $y = x$ ninety degrees counterclockwise and translate up two units.

- 56. Write the possible transformations performed to result in the image. Find another set of ordered pairs that would fit your transformation rules. What do you predict about the outcome?**

Pre-image: (3, 2)

Image: (-4, 5)

One possible set of transformations: Reflect pre-image about the y-axis. Translate up 3 units. Translate left 1 unit. Students may note that the image of several ordered pairs would be a glide reflection of the pre-images.

- 57. An example of symmetry in nature is . . .**

Students may find symmetry in the human body, leaves, animals, or other things. To extend the prompt, have students share their examples in class. Discuss how their examples show symmetry. What type of symmetry do their examples have?

- 58. Design your own drawing, painting, or sculpture in which you use transformations**

Students may use reflections, rotations, or translations to draw a picture, build a model building, make a dish, or any other creative ideas they have. This prompt can be used as a long-term project. Students' work should have an explanation of the transformations they used. You could put on a public showing of these pieces.

- 59. Juan asked, "Why do you think cereal boxes are in the shape of rectangular prisms?" Kavita said, "A box shaped like a pyramid would not be as cost effective." What do you think? Support your answer.**

Students should discuss the amount of cereal in a rectangular prism box versus a pyramid box. They should address the size of a container needed when it is a rectangular prism and the practicality of one needed when it is a pyramid. You may note that students compare volume formulas between the two shapes.

- 60. Sandra said, "As surface area increases, volume also increases." "Is that true?" asked Sydney. What do you think? Support your answer.**

Students should provide examples or a convincing argument to support their position that Sandra is not correct. This prompt is similar to the one related to two-dimensional shapes (perimeter and area of rectangles).

- 61. On a note card, write a word problem that involves volume or surface area. Show your solution on another card or on the back of the word problem.**

Use students' problems in class for others to solve.

62. Corey found a scrap of homework paper that said,

Volume is $2,816 \text{ m}^3$.

What could the problem have been?

Answers will vary. For example, find the volume of a cylinder that has a height of 14 m and a radius of 8 m. Pi was approximated. Regardless of the object that students use in their problems, they should give specifics about how the volume was found.

63. Write a convincing argument about this statement:

An oblique cylinder has the same volume as a right cylinder.

Remember that an argument can defend a statement as true or prove that it is false.

The argument should show the idea that the statement is true if the cylinders have the same base and the same height.

64. Ima Wandring said, "I had a dream last night that I won 1,000,000 drops of water from the fountain of youth. I wonder how big a container I would need to hold that much." What do you think? Justify your answer. Be sure to show how you determined it.

This is a good prompt for extended writing. Students' responses should be shared in some way, such as displaying on a bulletin board or having oral presentations. Some students may create a poster to show their response and solution method. It takes about half to two-thirds of a bathtub to hold this much water.

65. When I find volume, I have noticed that volume is affected by . . .

Students should comment on generalizations they have noticed. Some may indicate that base area or height is a factor in determining volume.

- 66. Surface area and volume are (or are not) related because . . .**

Students' responses depend on what you have discussed in class. Students may use specific shapes to illustrate the relationship between the area of bases and the volume.

- 67. Serena said she had a container that had a surface area of 1,400 square centimeters. Draw the container(s) Serena could have. Justify your drawings.**

There are multiple answers. For example, a rectangular prism with a square base, each side 10 cm and a height of 30 cm. Students should justify their responses. Look for multiple solutions.

- 68. It is (or is not) important to know the center of the circle because . . .**

Students usually comment that it is important to know the center because, by definition, a circle is the set of all points equidistant from a given point. That point is the center, which determines many characteristics of a circle.

- 69. Congruent circles and concentric circles are alike or different because . . .**

Students' responses should compare and contrast characteristics of these circles. Concentric circles have the same center but are not necessarily congruent.

- 70. Ron said, "The diameter of a circle is the largest chord." "No," said Ted. "The largest chord of a circle is a secant because it is a line, not a line segment." What could you add to this discussion?**

Students should comment that a chord does not extend outside the circle. In fact, the endpoints of the chord must be on the circle. Therefore a diameter is the largest chord.

- 71. Pizza R Us is trying to create a new package for the round pizzas it delivers. It wants a box that is cost-efficient and uses the smallest amount of material. Design a box for a round 14-inch pizza, and give a rationale for why your box is the best possible choice.**

Students will need additional time for this assignment. Their creations should be displayed. The suggestions they give can be explored as a class investigation. Students may offer arguments about the height of the pizza, which will affect the size of the box.

- 72. “Arc measure and arc length are confusing,” said Patrick. “I used to confuse them, but I learned how to tell them apart,” said Christopher. What do you think Christopher learned?**

Responses should indicate that arc length is some part of the circle’s circumference and is measured in a unit of length. Arc measure is measured in degrees.

- 73. Kasey said, “Pi is $22/7$.” “No, it’s not,” said Randi. “It’s 3.14.” What do you think? Validate your answer.**

Students should note that neither is correct. Both are only approximations.

- 74. Thad wanted to apply for a job that used coordinate geometry or trigonometry. Choose a job that you think would use one or both. Write a letter for Thad that would describe his skills that could be used the job.**

Students’ responses should realistically reflect jobs that use coordinate geometry or trigonometry. The skills students describe will give you a sense of what they feel is important to learn in those two areas.

- 75. Connie was doing her homework in trigonometry when she noticed that she was finding the tangent of angles in two triangles that were similar. How do you think the tangents would relate? Prove it.**

Students should provide good examples. Many will use AAA as part of their proof.

- 76. Holly spilled hot chocolate on her homework. All she could read was**

$$\sin q = 0.6$$

What do you think the problem was? Justify your answer.

Answers will vary. For example, what is the sine of an acute angle that measures 37° ?

- 77. The slope of a line is . . .**

Encourage students to use their own words, not the book's definition. Students usually refer to the steepness of a line. This opens many avenues for class discussion. Is a line that has a slope of -2 as steep as or steeper than a line that has a slope of 2 ? What is the maximum slope a line can have? Why? What is the minimum slope a line can have? Why?

- 78. Using coordinate geometry, I can check a quadrilateral to see if it is a parallelogram by . . .**

Students should use ideas about parallelograms with coordinate geometry in their responses. Look for comparisons of slope, length of sides, and so on. Any appropriate property of a parallelogram could be used.

- 79. Undefined slope and a slope of zero are (or are not) the same because . . .**

Students should indicate these are not the same and give supporting reasons. This prompt should reflect your class discussions about slope.

- 80. Perpendicular lines have slopes that are . . .**

Responses should show negative reciprocals.

Affective/Attitudinal Prompts: Geometry

1. When I am in geometry class, I feel _____ because . . .
2. Write a letter to your best friend describing what happens in our geometry class.
3. Draw a picture of a geometer on a typical work day. Describe the work one would do.
4. What does a geometer do for fun?
5. I think a geometry student is (or is not) a mathematician because . . .
6. I will probably (or probably not) use geometry when I get a job because . . .
7. Pick a song, a story, a picture, or a poem that shows how you feel about geometry. Describe why it shows your feelings.
8. If I could change one thing about our geometry class, it would be to . . .
9. A job that uses a lot of geometry is _____ because . . .
10. Using group work in geometry makes me feel . . .

11. **Geometry is . . . How does it compare to algebra?**
12. **Problem solving is . . .**
13. **Geometry is (or is not) related to arithmetic because . . .**
14. **My favorite thing in geometry this year was when . . .**
15. **My math class last year was the same as (or different from) this year's class because . . .**
16. **My parents (or guardians) did (or did not) like geometry because . . .**
17. **To be a better geometry student, I need to . . .**
18. **If I had to solve a geometry problem, I would (or would not) use a calculator because . . .**
19. **Computers are (or are not) useful in geometry because . . .**
20. **How could you show that geometry and science are related?**
21. **The one tool that is used most to do geometry problems is the _____ because . . .**
22. **Draw a picture of a "perfect" geometry student. Describe why your student is perfect.**

23. If I could change one thing about myself as a geometry student, it would be . . .
24. Studying geometry is (or is not) important because . . .
25. My feelings about geometry have changed (or have not changed) this year because . . .
26. The perfect geometry textbook would have . . .
27. A mathematician and a scientist are alike (or different) because . . .
28. Geometry has (or has not) changed in many years because . . .
29. I anticipate making a grade of _____ in geometry because . . .
30. Mathematicians use geometry to . . .
31. A company that is likely to hire someone who has strong geometrical understandings is _____ because . . .
32. Geometry can be useful in my future mathematics courses because . . .
33. The most interesting part of studying geometry is . . .

Process Prompts: Geometry

1. **Janelle is trying to decide what would be a good method to solve an area problem involving quadrilaterals. Describe your method using at least three different quadrilaterals.**

Students should show three different quadrilaterals, such as a trapezoid, a rectangle, and a rhombus. Their methods should be accurate. To extend the prompt, ask students to compare their methods for each class or type of quadrilateral.

2. **My favorite method of determining congruent triangles is to . . .**

Accept any mathematically correct method for determining congruency. For class discussion, you may want to ask students to apply their methods to other shapes.

3. **Tara asked, "Can I use the same method to find similar shapes, regardless of the shape?" What would you tell Tara?**

Students should consider angle congruency, side ratios, and so on. Watch for responses that do not consider that similar figures must have the same shape.

4. **Studying for a geometry test is the same as (or different from) studying for a geometry quiz because . . .**

Students' responses will give you indications of how they view the differences or similarities between tests and quizzes. Additionally, you can see the study patterns that students use in either case.

- 5. Kevin said, "There's a secret to being able to solve a word problem." What do you think Kevin's secret could be? Explain.**

Students may refer to Polya's four-step approach to solving problems, or they may describe techniques unique to them. If you see responses that include ideas you think other students could benefit from, you may want to have those ideas shared.

- 6. When I see a word problem, I first _____. Then I . . .**

Students should describe their thinking process when they encounter a word problem. You may also note that students will share affective views.

- 7. Before I begin to solve a similarity problem, I first . . .**

Students often describe the criteria of similar figures that they check before they begin working on the problem. These criteria may include finding the corresponding sides or determining the ratios between sides. Others may include corresponding angles.

- 8. The problem-solving strategy I use the most in geometry is _____ because . . .**

Students should list at least one problem-solving strategy with an explanation.

- 9. Learning geometry is (or is not) like learning arithmetic because . . .**

Students compare geometry to arithmetic. Their responses give you an indication of the links they see between the two subjects.

- 10. Before I start graphing an equation, I must first think about . . .**

Students' responses should be closely linked with class discussion of graphing. You can be more specific with the type of equation you want students to consider, or you may want to ask students to include a specific example of the equation they are referring to in their response.

- 11. I would understand geometric ideas better if . . .**

Students' responses may give you some ideas to consider for instructional strategies. Or you may gain more insight into what helps your students learn.

- 12. Learning geometry is easier when I . . .**

You may understand what students consider to be helpful in their learning with reference to geometry.

- 13. The most important thing to learn in geometry is . . .**

Responses indicate the important topics or processes that students have identified.

- 14. I can justify my solution to a volume problem by . . .**

Students should give an appropriate method for estimating or determining the reasonableness of an answer related to volume.

- 15. To draw a three-dimensional shape so that it is a good representation of the actual figure, I must consider . . .**

Students often think of the three-dimensional representation with regard to hidden faces. You may find other possibilities in their responses.

16. When I compare the size of two shapes, I think about . . .

Students should mention various ways to consider size. Some possibilities are length, width, height, area, perimeter, surface area, and volume.

17. Some of the methods I learned in algebra can (or can not) be used in geometry because . . .

Responses give you an indication of what students use from their previous mathematics experiences. These processes may be useful in discussing specific problems.

18. When I see a problem I don't know how to work, I . . .

An important part of being a good mathematics student is developing ways to attack an unknown problem. Strategies given in the responses can be useful in helping individual students become better problem solvers, or you can use those responses to share with the whole class.

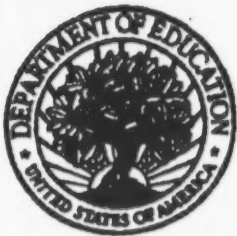
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